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Anxiety and depression in young and middle-aged hypertensive and normotensive subjects

W. Gibson Wood, Merrill F. Elias, Norman R. Schultz & Clyde A. Pentz

Anxiety and depression in young and middle-aged hypertensive and normotensive subjects. *Experimental Aging Research*, 1979. 5(1) 15-30. This study examined the effects of essential hypertension on measures of anxiety and depression for two age groups of hypertensive (free from hypertension-related pathology and/or cardiovascular disease) and normotensive subjects. Hypertensive subjects had significantly higher State Anxiety scores and Zung Depression scores than did normotensive subjects. These differences between the blood pressure groups were due largely to the scores of the younger hypertensive subjects. The results of the present study are consistent with previous results from our laboratory that have found that younger hypertensives differed (relative to controls) from middle aged hypertensives on measures, such as, symptoms reported on the Cornell Medical Index. and WAIS Performance scores. The results of the present study were discussed within the context of age associated differences in response to hypertension and factors that might account for these differences.

A number of investigations have been concerned with the interaction of age and hypertension as it affects cognitive behavior (Birren & Spieth, 1962; Light, 1976; Schultz, Dineen, Elias, Pentz, & Wood, in press; Spieth, 1966; Wilkie & Eisdorfer, 1971). Investigators have also described the relationship of anxiety and depression to advancing age (Busse, 1961; Gurin, Veroff, & Feld, 1960). Very few, if any, studies have examined the relationships among age, hypertension, and measures of anxiety and depression in the same study. Investigations of anxiety and depression in relation to hypertension and age are particularly important as performance differences between old and young hypertensive subjects may reflect personality factors and situational response to stress as well as cognitive factors per se.

Several investigators have suggested that there may be a relationship between anxiety and/or depression and hypertension (Esler, Julius, Zweifel, Randall, Harburg, Gardiner, & DeQuattro, 1977; Friedman & BeMet, 1977; Heine, 1970; Heine, Sainsbury & Chynoweth, 1969; Pilowsky, Spalding, Shaw & Koier, 1973; Wheatley, Balter, Levine, Lipman, Bauer, & Bonato, 1975). Heine, et al. (1969) reported that ratings of anxiety and agitation were correlated

significantly with blood pressure in individuals with the diagnosis of "primary depressive illness." Also, blood pressure was related positively to both the duration and frequency of depression. Symptoms of depression that were measured by the Hamilton Depression Scale were not associated with hypertension. In a subsequent study Heine (1970) replicated his earlier findings using a larger number of subjects and a normotensive control group.

Results similar to those observed by Heine and his co-workers have been reported by Friedman and BeMet (1977). The clinical diagnosis of anxiety was associated with hypertension. Scores on the Zung Depression Scale were not shown to be associated with hypertension. A problem with the study reported by Friedman and Bennet is that hypertension may not have been the primary disease for which an individual was being treated. The majority of subjects in their study had at least "one or two long standing illnesses" in addition to hypertension.

A relationship between anxiety and hypertension has been reported by Pilowsky, et al. (1973). They found that anxiety measured on the IPAT Anxiety Questionnaire was related to measures of vascular status, e.g., resting heart rate, resting diastolic and systolic blood pressure. However, their hypertensive subjects were not compared to a normotensive control group, and they did not report when the psychological tests were administered in relationship to the time of administration of the cardiovascular measures. Further, the age range used was quite wide (22-47 years).

In a study in which a normotensive group was compared to a hypertensive group, Wheately, et al. (1975) failed to find an association between hypertension and anxiety. However, the normotensive subjects in their study were not free of medical problems such as angina pectoris and myocardial infarction, and the hypertensive subjects displayed a variety of medical problems in addition to hypertension. Esler, et al. (1977) also failed to find a relationship between anxiety and hypertension when normal renin hypertensives and high renin hypertensives were compared with normotensive subjects ranging in age from 18 to 35 (a smaller age range than that employed by Pilowsky, et al., 1973).

The relationship among hypertension, age, and anxiety and depression remains unclear. Not only have age by blood pressure interactions not been considered but there are a number of methodological problems with the studies reviewed here: (1) some studies have not used objective measures of anxiety (Friedman & Bennet, 1977; Heine, et al., 1969; Heine, 1970) or

depression (Wheatley, et al., 1975); (2) studies have used hypertensive subjects with chronic medical problems in addition to hypertension (Friedman & BeMet, 1977; Wheatley, et al., 1975); (3) normotensive control groups have not been used in some studies (Heine, et al., 1969; Pilowsky, et al., 1973). Thus, one purpose of this study was to determine whether *young* and *middle-aged* hypertensive subjects differ with respect to *objective* measures of anxiety and depression. A second question raised in this study was whether hypertensive subjects without diagnosed hypertension-related pathology and major medical problems would differ from relatively healthy normotensive subjects on the measures of anxiety and depression. Finally, this study examined whether anxiety was specific to the testing situation, i.e., "state anxiety", or if the anxiety was more closely related to a general characteristic of the subject, i.e., "trait anxiety" (Spielberger, Lushene, & McAdoo, 1971).

METHOD

Subjects

Twenty-seven essential hypertensive subjects (18 males; 9 females) and 34 normotensive subjects (15 males; 19 females) participated in the study. The hypertensive subjects were recruited from a hypertension clinic at Upstate Medical Center (State University of New York) in Syracuse, New York, where they had been undergoing a medical diagnostic examination (see Streeten, Anderson, Freiberg, & Dalakos, 1975) which included studies of plasma renin activity. The normotensive (control) subjects were recruited from various church groups, businesses, and Syracuse University. Fourteen of the normotensive control subjects were medically examined controls (ME). The ME controls were volunteers from the community who had undertaken the same medical diagnostic examination at Upstate Medical Center as was given to hypertensive subjects. The remaining 20 control subjects were non-examined subjects (NE) who were recruited directly to our laboratory. Hypertensive subjects, ME controls, and NE control subjects had all participated in studies of WAIS performance (Schultz, et al., in press) and performance on selected tests of the Halstead Neuropsychological Test Battery (Pentz, Wood & Elias, Note 1).

All hypertensive subjects in this study were individuals that had been (1) referred to the Upstate Medical Center Clinic as hypertensives; (2) diagnosed as hypertensive at the clinic, and (3) displayed a mean arterial pressure of 105 mm Hg or greater at our laboratory during the day

of testing. Normal blood pressure was defined as a mean arterial pressure (MAP) of less than 100 mm Hg. Individuals with a MAP between 100- and 105-mm Hg were not included in the study. The MAP for each subject was calculated as follows: diastolic blood pressure + $\frac{1}{3}$ pulse pressure (Guyton, 1971). All hypertensive subjects had systolic and diastolic blood pressure values (mm Hg) of 140/90 or above and all normotensive subjects had blood pressure values of 130/80 or less.

Hypertensives and ME controls (normotensive subjects) with the following histories, or symptoms upon examination, were eliminated from our sample: angina pectoris, congestive heart failure, kidney transplant, improper use of medication, type II or type III eye ground changes, cerebral vascular accident, myocardial infarction, or kidney failure. The NE controls did not undergo the medical examination given to hypertensive subjects and ME controls. However, the NE controls reported good health and did not differ from the ME controls on their responses to the Cornell Medical Index (Wood, Elias, Schultz, & Pentz, 1978).

Procedures

A total of five blood pressure readings were made before the administration of the tests at our laboratory. The standard auscultation technique was used. Blood pressure was measured while the subject was seated. The tests used in this study were the Zung Self-Rating Depression Scale (Zung, 1965) and the State and Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970). The Zung Depression Scale is a 20 item self-reporting test that contains statements symptomatic of depression, e.g., I feel downhearted, blue and sad; I have crying spells or feel like it. The State and Trait Anxiety Inventory consists of 20 items each; measuring State Anxiety, e.g., I am relaxed, I am comfortable; and Trait Anxiety, e.g., I try to avoid facing a crisis or difficulty, I am a steady person. The three tests were administered as a part of a battery of cognitive tests that have been described elsewhere (Schultz, et al., in press; Pentz, et al., Note 1). The tests were administered separately, beginning with the State Anxiety Test followed by the Trait Anxiety Test and Zung Depression Scale. Standard procedures for the administration of the three tests were used (Spielberger, et al., 1970; Zung, Note 2).

Design and Analyses

Preliminary analyses of variance indicated no significant gender main effects and interactions of gender with any other factor on the anxiety and depression scores. Thus, males and females were collapsed within the hypertensive and normotensive groups.

In order to examine the effects of medication on the hypertensive subjects' anxiety and depression scores, the hypertensive subjects were placed in one of two groups: (1) on medication at the time of testing; and, (2) off medication when tested. The anxiety and depression scores were examined also between the ME and NE controls. Preliminary analyses of variance indicated no significant differences on the anxiety and depression scores for subjects that were medicated at the time of testing and subjects that were not medicated ($ps < 0.27$). These two groups were combined into a single hypertensive group. Similarly, no differences were found between ME controls and NE controls ($ps < .32$). Thus, the latter two groups were collapsed into a single control group. Table 1 summarizes the mean age, systolic blood pressure, diastolic blood pressure and mean arterial pressure and years of education for young and middle-aged hypertensive subjects and the young and middle-aged normotensive subjects. Final analyses of variance were done with two (Blood Pressure Group: hypertensive and control) by two (Age Group; young and middle-aged) analysis of variance for each of the three dependent variables: state anxiety score, trait anxiety score, depression score.

An *a priori* decision was made to compare statistically the hypertensive and normotensive subjects at each age group and the two age groups within the hypertensive and normotensive groups regardless of the test of the Blood Pressure Groups x Age Interactions. These *a priori* comparisons were performed with the conservative Tukey (a) test using the harmonic mean correction (Winer, 1962, 85-89, 101) and were undertaken because previous findings from our laboratory have indicated: (1) that young hypertensives report a relatively greater number of symptoms (relative to controls) on the Cornell Medical Index than do middle-aged hypertensives (Wood, et al., 1978) : and, (2), the effect of blood pressure on WAIS Performance scores was greater (relative to controls) for younger than for older subjects (Schultz, et al., in press). *A priori* tests can and should be done when, as in the present experiment, they are specifically built into the design (see Winer, 1962, p. 208).

RESULTS

Table 2 summarizes the F values and degrees of freedom for the Blood Pressure by Age analyses of variance. Significant main effects for Blood Pressure Group were obtained for State Anxiety ($p < 0.04$) and Zung Depression scores ($p < 0.04$). Main effect for Blood Pressure Group was not significant for Trait Anxiety. Means were as follows for the hypertensive versus normotensive subjects: State Anxiety (34.4 vs. 30.4); Zung Depression (42.7 vs. 38.4); Trait Anxiety (36.3 vs. 33.4).

The main effect of Age was significant ($p < 0.01$) for State Anxiety scores but not for Trait Anxiety or Zung Depression scores. The older subjects exhibited lower State Anxiety scores than the younger subjects (30.24 vs. 35.13).

Table 3 shows means and standard errors of the mean for State and Trait Anxiety scores and depression scores for the young and middle-aged hypertensive and normotensive groups. It may be seen that the young hypertensive subjects exhibited higher scores for the three measures when compared to the middle-aged hypertensives and the young and middle-aged normotensives. The Blood Pressure Group by Age interactions were not significant for the three dependent variables, but the planned multiple comparisons revealed differences in findings for the two age groups. Zung Depression scores were significantly higher for the young hypertensives than for the young normotensives subjects ($p < 0.05$). The young hypertensive subjects also exhibited higher State Anxiety scores than the middle-aged hypertensive ($p < 0.05$) and middle-aged normotensive subjects ($p < 0.02$). The middle-aged hypertensive subjects did not differ significantly from the young and middle-aged normotensive subjects for any of the three dependent variables ($ps > 0.05$).

Pearson product-moment correlation coefficients were calculated separately for the normotensive and the hypertensive groups in order to examine the relationship among the anxiety and depression scores and systolic, diastolic, and mean arterial blood pressure. Correlations among the three test scores and blood pressure values were not significant. The pattern of correlations among the anxiety and depression scores was different for the hypertensive and normotensive subjects. Table 4 shows that significant positive correlations were found between the Zung, State, and Trait scores for the hypertensive subjects. For the normotensive subjects a significant correlation was obtained between the Zung Depression scores and the Trait Anxiety scores, but not between the Zung Depression scores and State

Anxiety scores. State and Trait Anxiety scores were not correlated significantly for the normotensive group.

The Zung Depression Scale can be grouped into four subscales, i.e., depressed mood index, well-being index, somatic symptoms index, and optimism index (Blumenthal, 1975). Multivariate analysis of variance (with MANOVA: Clyde, 1969) indicated that the main effect of blood pressure was significant ($p < 0.001$). Univariate analysis of variance for each of the subscales revealed that only the somatic symptoms index differed significantly for comparisons between the hypertensive and normotensive groups ($p < .001$) The mean somatic index for the hypertensive subjects was higher than for the normotensive subjects (3.83 vs. 2.29). Multivariate analyses of variance indicated non-significant main effects for Age and a nonsignificant Blood Pressure Group by Age interaction. Since the grouping of the Zung Depression scores into subscales was done on an *a posteriori* basis, and both the multivariate Age main effect and interaction of Blood Pressure and Age were not significant, further statistical tests were not done.

DISCUSSION

In the present investigation, individuals with essential hypertension exhibited higher State Anxiety scores and Zung Depression scores than did normotensive subjects. The hypertensive subjects and the control subjects did not differ on the Trait Anxiety scores. The State Anxiety part of the State and Trait Anxiety Inventory is purported to be sensitive to anxiety associated with a specific situation as opposed to a “habitual tendency to be anxious over a long period of time”, i.e., Trait Anxiety, (Spielberger, et al., 1970).

The finding that hypertensive individuals scored higher than normotensive subjects on the Zung Depression Scale differs from results reported by Friedman & Bennet (1977). One possible reason why the results of the two studies differ is that the hypertensive subjects used in the present study were diagnosed medically free of any hypertension-related pathology, e.g., eye ground changes, kidney disease, and cardiovascular disease. In the study reported by Friedman and Bennet (1977) the subjects were not screened for hypertension-related pathology and/or cardiovascular disease. In addition, the subjects in the present study consisted of young and middle-aged individuals while the subjects in the study reported by Friedman and Bennet (1977) were generally “40 years of age or older”.

Friedman and Bennet (1977) did report that hypertension was associated positively with the Somatic Symptoms Index score when subscales of the Zung Depression Scale were

examined. However, this was true only for a mild hypertensive group. In a general sense, the present finding of a higher Somatic Symptoms score for essential hypertensives is consistent with their finding. Comparisons between severely hypertensive and moderately hypertensive subjects were not undertaken in our study as almost all subjects were moderately hypertensive (see Table 1).

Our finding that hypertensive individuals scored higher on the Zung Depression Scale than did normotensives is also not consistent with findings by Heine (1970) and Heine, et al. (1969) and Wheatley, et al. (1975). Heine and his co-workers reported that symptoms of depression measured by the Hamilton Depression Scale were not associated with hypertension. However, the subjects used in the studies by Heine and his associates were individuals who were psychiatric patients with a diagnosis of “primary depressive illness”. The subjects in the present study were not psychiatric patients. Wheatley, et al. (1975) did not find an association between hypertension and depression. However, depression was assessed both subjectively by a “physician’s report” and the Symptom Self-rating scale. Also, some of the subjects in the study by Wheatley, et al. (1975) exhibited hypertension-related pathology and/or cardiovascular disease.

The results of the present experiment must be qualified in several important ways. First, the mean differences between the hypertensive and normotensive subjects, (i.e., higher Zung Depression and State Anxiety scores) are significant statistically, but they are not clinically significant. The means of the hypertensive subjects for anxiety and depression scores fall within a range that is considered to be “normal” based on the normative data provided by Zung (Note 2) and Spielberger, et al. (1970). Secondly, and most important, the hypertensive subjects in our sample knew that they were hypertensive prior to testing. Hypertensive subjects may have been sensitized to somatic and psychological symptoms and this sensitization may have affected their response to the anxiety and depression tests. An important question which must be answered is whether undiagnosed hypertensives who are free from hypertension related pathology and general medical problems would show elevated scores (relative to normotensives) on tests of anxiety and depression.

It is important to note that differences between hypertensive and normotensive groups were due largely to differences for the younger group of subjects. The finding that young hypertensives differ from the middle-aged hypertensives and normotensives is consistent with

results in our laboratory in previous studies with this same sample of subjects. Wood, et al. (1978) found that young hypertensive subjects reported more physical and psychological symptoms on the Cornell Medical Index than did older hypertensive subjects and older and younger normotensive subjects. We have no immediate explanation for these findings although several speculations can be offered. We may speculate that the diagnosis of hypertension may be more psychologically distressing for younger *than for* older individuals and thus they may be more sensitive to psychological and physiological complaints. Alternatively, selective dropout of individuals who develop more serious forms of hypertension by middle-age may result in a sampling bias favoring a lesser incidence of reported symptoms by the older group.

Clearly, other sampling biases related to the cross-sectional design employed may have influenced these data. It would seem that the longitudinal design is the design of choice in order to test the selective dropout hypothesis. A longitudinal design with larger numbers of subjects than the number employed in the present study would permit the comparison of younger subjects who "dropout" versus those that remain in the study until middle age.

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This study was supported in part by a grant from the National Institute on Aging (AG-00868) to Merrill F. Elias. Address reprint requests to: W. Gibson Wood or Merrill F. Elias. Dr. Wood is a Cooperating Assistant Professor of Psychology, University of Maine, Orono. Dr. Elias is a member of the Associate Medical Staff at the Bangor Mental Health Institute.